GUIDELINES FOR

Tree Seed Crop Forecasting and Collecting

Ministry of
Natural
Resources

Ontario

Hon. Vincent G. Kerrio
Minister

Mary Mogford
Deputy Minister

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Formerly titled Guidelines for Tree Seed Crop Forecasting.

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Preface

This manual is designed to provide detailed information for all people involved in tree crop forecasting and collecting operations. All tree species that are currently required in Ministry of Natural Resources forest and wildlife management programs have been included in this manual. Information on other species is available on request from the Tree Seed and Forest Genetics Unit, Room 3632, Whitney Block, Queen's Park, Toronto, Ontario M7A 1W3.

Introduction

The Ministry of Natural Resources (MNR) has a large artificial regeneration program which reflects Ontario's commitment to forest management. Successful artificial regeneration through seeding and planting seedling stock requires first and foremost, an adequate supply of high quality seed.

Good supplies of high quality seed can be achieved by

- implementing a sound tree improvement strategy for major regeneration species;
- accurate forecasting and identifying the season's best seed sources;
- proper collection, handling and shipping practices;
- good extraction, cleaning and storage methods.

General information is presented here for an overview and specific, descriptive information for each species follows.

Forecasting

Why forecast

Forecasting provides information to guide collectors to the best stands and help managers plan effective use of manpower, time and funds. This is important because many of our forest species produce good seed crops only periodically, and in good crop years, yields and quality are significantly better. When flowering is abundant, the pollen is heterogenous and plentiful; hence higher pollination, fertilization, seed set, germination and seedling vigor are possible. Further, seed collected from bumper crop years tends to maintain its high viability in storage longer. Intervals between good crop years tend to follow a pattern and this is referred to as periodicity. The periodicity for each species is given in the following guidelines.

Field equipment for forecasting

Standard equipment for forecasting includes a pair of high-quality binoculars, an extendible pruning pole, a hand lens, a pocket knife, and a cone cutter (Appendix I).

When to forecast

Generally, cones or fruits can be observed several weeks after flowering. Average periods for each species are given in the manual, but geographic differences will be evident. Note that in pines, it takes two years for a cone to develop and forecasts should be based on second year conelets.

Estimating the seed yields

For all species, it is important to sample several fruits or nuts from various parts of the crown to check for embryo development and potential seed yields.

In pines and spruces, potential seed yields can be determined at this point through a cutting test. The cone is cut in half longitudinally along the axis and then allowed to sit for a few minutes so that the cut surface can darken. The potential yield per cone is estimated by counting the number of filled seed that the knife has cut and multiplying by four (see Appendix I). A range of average yields by species is shown in Appendix II. The cutting test is also valuable for examining seed maturity and detecting insect damage.

In cedars and hemlocks, seeds can be counted simply by pulling apart the cone scales and shaking out the seeds. In maples, ashes and walnuts, it is important to sample several seeds or nuts to check for potential embryo development. This can be done by slicing the seed portion of the samara or the nut. For other hardwood species, a visual count of developing fruit is usually sufficient to estimate the potential crop.

Factors affecting forecasts

(Species flowering habit)

A knowledge of the flower-seed relationship is important to the crop forecaster. When flowers are unisexual or imperfect, the male and female flowers may both occur on the same tree, which is described as monoecious. It is only the female flowers that develop into seed-bearing cones or fruit.

When the male flowers and the female flowers occur on different trees, the species is termed dioecious.

This manual identifies each species by these terms.

Selecting the collection area

Crop collections should come from seed orchards, seed production areas, seed collection areas and gene pool reserves whenever possible.

However, seed required for aerial-seeding operations may be collected from healthy natural stands. Ideally, dominant and co-dominant vigorous trees within natural stands should be chosen for seed collections. Avoid isolated trees where self-pollination is very probable.

Field equipment for collecting

Standard equipment for the collection of tree seed crops includes a cone cutter or a sharp cutting knife, picking bags and/or tarpaulins, burlap bags, plastic bags (for use as liners in burlap bags when collecting pulpy fruit), linen tags, permanent ink markers, ladders (standard, extension, and/or tripod), bamboo poles, gloves for certain species, clipboard and record-keeping sheets.

Assessing the crop

Prior to collection, check for aborted cone or fruit development. Insect-damaged cones will feel rubbery and appear underdeveloped when compared to healthy cones. This could be a sign of insect infestation or site stress.

Since insect damage may not be visible on cones or fruit, it is important to do another cutting test. For nut species, a cracking test is recommended. For ash and maple species, the seed may be observed by slicing the seed portion of the samara into two flat halves. Note that in hard maple, it is normal for only one seed in a pair to be filled.

Be aware of warm microclimates that may have brought on early flowering and early seed development.

Collection methods

For species such as black spruce and jack pine, where cutting operations are frequent, it is possible to make cone collections from the cone-bearing tops found in the slash. Tops can be collected and taken to a convenient, central location for cone removal. Jack pine cones can be hand-picked using pruning shears. Black spruce cones may also be hand-picked but mechanical methods may prove to be more economical. Modified combines, thrashers and rakes can be used to separate cones from branches and debris.

Topping of standing trees is an alternative for black and white spruce trees that do not have an aesthetic value. This should be done only in years of abundant crop production and only in areas where it does not affect the value of the residual tree. This method is most effective in species with fruits that are predominantly clustered at the very top of the tree, such as white pine and white spruce.

Tree climbing and hand-picking is a safe and suitable means of collection for many species, as long as proper safety measures are taken.

For many of the hardwood species, or on private land where it is important not to damage the tree, climbing and hand picking are best. Tree climbing equipment such as pole spurs, tree bicycles, ladders or poles can assist in bringing the picker closer to the cones or fruits. A comprehensive booklet entitled *Safe Tree Climbing in Forest Management* (see Bibliography) provides detailed information on the various pieces of equipment and tree climbing procedures.

In seed orchards, hydraulic lifting equipment such as cherry pickers are useful for getting into the tree crowns.

Squirrels

If squirrels are present in the collection area, they may have nipped off the cones and let them drop to the ground. Often collectors can go directly to their caches to find stores of cones, nuts or acorns.

Bagging and Shipping

Bagging and labelling

Cones and/or fruits should be packed for shipping in burlap bags with 60 litres measured accurately in each bag. Pulpy fruits should have a plastic bag inserted inside the burlap bag for shipping. It is important to keep pulpy fruit moist. Bags should be tied securely and identified with linen tags showing: (i) point of origin; (ii) seed source number (see Appendix III); (iii) number of litres in the bag; (iv) total number of bags in shipment. A duplicate tag must also be placed inside the bag to ensure correct identification.

Note bags, tags and 40 litre measures are available to MNR personnel from the Ontario Tree Seed Plant at Angus (address in Appendix IV).

Shipping

Cones and fruits should be shipped as soon as possible to avoid damage to seed. When this is not possible, store cones and fruits as specified for each species in the manual. Use refrigerated transport when cones or fruit have a high moisture content and require shipping over a long distance.

Fruits such as black walnut, maple, ash and oak do not store well and should be shipped promptly to the appropriate nursery.

Conifers

Figure 1 Anatomy of a cone.

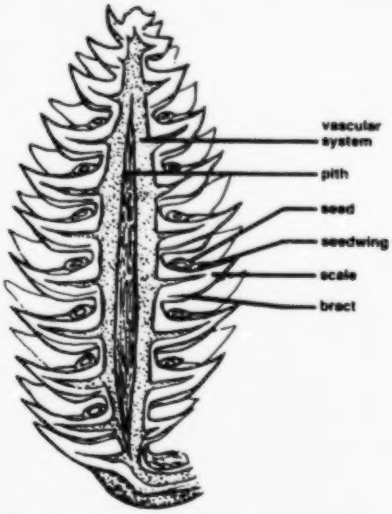
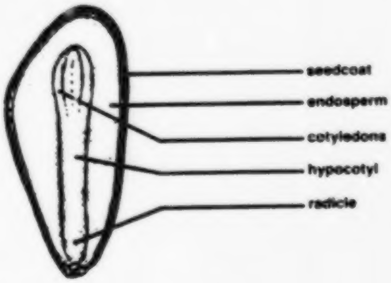

vascular system
pith
seed
seedwing
scale
bract

Figure 2 Conifer seed anatomy.


seedcoat
endosperm
cotyledons
hypocotyl
radicle

European Larch

Larix decidua Mill.

Crop intervals
- three to ten years

Flowering habit
- monoecious, flowering late April to May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- green cones that are close to full size

Forecasting notes
- use cutting test at time of forecasting to check embryo development and possible insect damage
- previous years' cones may remain on the tree for a number of years

Collecting

When to collect
- mid-September to October

Description of ripe cones and mature seed
- cones are 3 cm to 4 cm long, cylindrical, with cone scales tightly appressed
- ripe cones are light brown
- cones sit upright on the branch
- seeds are 3 mm to 4 mm long and somewhat triangular
- mature seed has a light brown seed coat, a firm white endosperm and a white-to-yellow embryo that extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Larix decidua Mill.

Forecasting

Collecting

Collection methods
- collect cones only when seed is fully mature
- cones can be collected from standing trees, slash, or squirrel caches
- use ladders to access the crown
- collection is somewhat difficult since the cones are firmly attached to branches
- cones can be removed by hand or with pruning shears
- remove cones carefully to avoid damaging branches

Collection notes

- use cutting test to check internal cone and seed features
- fertilization tends to be very low, so a high percentage of unfilled seed is common
- avoid collecting cones which are visibly damaged by insects, appear malformed, or are void of seed
- climbing is not recommended since cones are spread throughout the crown (thus difficult to reach) and because branches are too brittle to permit safe climbing
- since cones remain on branches for several years make sure only the current year's cones are collected

Storage and shipping procedures

- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and/or moulding

Tamarack

Larix laricina (Du Roi) K. Koch

Crop intervals

- three to six years

Flowering habit

- monoecious, flowering late April to May

Forecasting

When to forecast

- end of June to first week of July

What to look for

- cones that are greenish purple and close to full size

Forecasting notes

- use cutting test at forecasting time to check embryo development and possible insect damage
- previous years' cones may remain on the tree for several years

Collecting

When to collect

mid-August to early September

Description of ripe cones and mature seed

- cones are 1 cm to 2 cm long, oblong, with cone scales tightly appressed
- ripe cones are brown
- cones sit upright on the branch
- seeds are 2 mm to 3 mm long and somewhat triangular
- mature seed has a brown seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Larix laricina (Du Roi) K. Koch

Forecasting

Collecting

Collection methods

- collect cones promptly after seed has matured
- cones are best collected from standing trees using ladders
- cones can be removed either by hand-picking or hand-stripping directly into picking bags or onto ground sheets

Collection notes

- check cones often as they near maturity because seed dispersal can occur quickly
- use cutting test to check internal cone and seed features and insect damage
- avoid collecting cones that are visibly damaged by insects or appear malformed
- climbing is not recommended since cones are spread throughout the entire crown (thus difficult to reach) and because branches are too brittle to permit safe climbing
- since cones remain on branches for several years make sure that only the current year's cones are collected

Storage and shipping procedures

- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and/or moulding

Japanese Larch

Larix leptolepis (Sieb.& Zucc.) Gord.

Crop intervals
- three to six years

Flowering habit
- monoecious, flowering April to May

Forecasting

When to forecast
- last week of June to the first week of July

What to look for
- cones that are light green and close to full size

Forecasting notes
- use cutting test at time of forecasting to check on embryo development and possible insect damage
- end of cone looks like a rose

Collecting

When to collect
- mid-September to mid-October

Description of ripe cones and mature seed
- cones are 2cm to 3cm long, ovoid, and have scales which bend outwards at their tips giving a rose-like appearance
- ripe cones are brown
- cones sit upright on the branch
- seeds are 3mm to 4mm long and somewhat triangular
- mature seed has a light brown coat, a firm white endosperm and a white-to-yellow embryo which extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Larix leptolepis *(Sieb.& Zucc.)* Gord.

Forecasting

Collecting

Collection methods
- collect cones promptly after seed has matured
- cones can be collected from standing trees or squirrel caches
- collections are best made by hand-picking directly into picking bags from standing trees using ladders to access the crown
- cones can also be clipped from branches using pruning shears
- remove cones carefully to avoid damaging branches

Collection notes
- check cones often as they near maturity because seed dispersal occurs almost immediately after the seeds reach full maturity
- use cutting test to check internal cone and seed features and insect damage
- climbing is not recommended since cones are spread throughout the crown (thus difficult to reach) and because branches are too brittle to permit safe climbing
- collection is difficult since cones are firmly attached to branches and are spread throughout the crown
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- since cones remain on branches for several years make sure only the current year's cones are collected

Storage and shipping procedures
- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and/or moulding

Norway Spruce

Picea abies (L.) Karst

Crop intervals
- three to five years

Flowering habit
- monoecious, flowering late April to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones should be green and about half their full size

Forecasting notes
- use cutting test at time of forecasting to check on embryo development

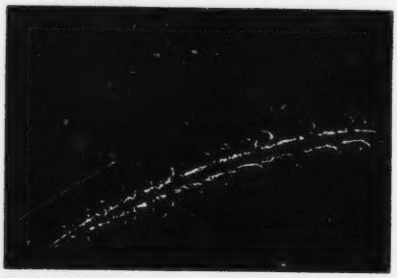
Collecting

When to collect
- late August to late October

Description of ripe cones and mature seed
- cones are 12 cm to 18 cm long, cylindrical, and composed of many thin, closely overlapping scales
- cone scales can vary in shape from triangular with slightly wavy margins (europa type) to rounded with smooth margins (obovata type)
- ripe cones are greenish brown to light brown
- seeds are 4 mm to 5 mm long, rounded at one end and tapered to a point at the other
- mature seed has a black seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Picea abies (L.) Karst

Forecasting



Collecting

Collection methods

- collect cones only when seed is fully mature
- cones can be collected from standing trees or squirrel caches
- Collect cones by hand-picking from standing trees using ladders to access the upper crown or by climbing

Collection notes

- use cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- if collecting from ornamental trees care should be taken to avoid mechanical damage to the bole or branches

Storage and shipping procedures

- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a relatively cool, dry, well-ventilated area
- cones should be inspected daily for signs of heating or moulding
- daily stirring or raking of cones should be conducted to ensure even drying and to prevent moulding

White Spruce

Picea glauca (Moench) Voss

Crop intervals
- two to eight years

Flowering habit
- monoecious, flowering in May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones should be green and close to full size

Forecasting notes
- note insect damage (white spruce is quite susceptible to attack)
- cutting test can be used during forecasting to check embryo development
- white resin on cone surface and malformation (such as banana-shape cone) could indicate insect damage

Collecting

When to collect
- August to mid-September

Description of ripe cones and mature seed
- cones 4 cm to 6 cm long, cylindrical and composed of many thin, close overlapping scales; the margins of the cone scales are smooth
- ripe cones are light brown but can vary from green to reddish brown
- seeds are 2 mm to 4 mm long, rounded at one end and tapered to a point at the other end
- mature seed has a brown-to-black seed coat, a yellowish and firm endosperm (it resembles coconut meat), and a firm white-to-yellow embryo that nearly extends the length of the endosperm cavity

Picea glauca (Moench) Voss

Forecasting

Collecting

- cones are ready to collect when embryo can be removed with the point of a knife
- these conditions in endosperm and embryo development are reached just before the seed coat changes colour
- once seed coats change from light brown to black, collection should be carried out within two weeks
- seed is generally mature before the cone exhibits fully ripe characteristics

Collection methods

- cones can be collected from standing trees, slash, or squirrel caches
- cones from high-value trees should be collected by hand-picking or hand-stripping directly into picking bags using ladders, or by climbing to access the crown
- in mature stands where the appearance of the trees is of minor importance, topping or clipping of branches is a rapid method of collection
- collections from slash can be made by hand-stripping cones at the cutting site
- alternatively, tops can be transported to a central location where cones can be hand-stripped or mechanically removed using top-strippers and combines

Collection notes

- collect cones promptly after seed has matured as cones open soon after ripening, especially during dry weather conditions
- use the cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- when using the topping method in areas where damage to the tree is acceptable, tarpaulins should be spread out beneath the tree (space permitting) to catch tops and branches as they drop; this will reduce losses due to cones dislodging and scattering as branches fall

Storage and shipping procedures

- ship cones immediately to the processing centre
- if shipment is over long distances, ship by refrigerated freight
- temperature in refrigerated freight must be above freezing, ideally between 2°C and 6°C
- if immediate shipment is not possible, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and moulding
- daily stirring or raking of cones should be conducted to ensure even drying
- for shipping, bags should be filled with 40 litres of cones with each bag tied at the top to allow for cone expansion

Black Spruce

Picea mariana (Mill.) BSP

Crop intervals
- two to eight years

Flowering habit
- monoecious, flowering May to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones that are purplish green and close to full size

Forecasting notes
- check cone for insect damage (may be indicated by white resin on cone surface or malformed cones)
- cutting test at time of forecasting may not permit determination of embryo development

Collecting

When to collect
- September through to winter months

Description of ripe cones and mature seed
- cones are 1 cm to 3 cm long, ovate, and composed of many thin tightly appressed scales with rounded, notched margins
- ripe cones vary from deep purple to brown
- seeds are very small, 1 mm to 2 mm long, oblong, and gradually taper to a point at one end
- mature seed has a black seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Picea mariana (Mill.) BSP

Forecasting

Collecting

Collection methods
- collect cones only when the seed is mature
- cones can be collected from standing trees, slash, or squirrel caches
- collections from short trees (as in young stands, plantations or seed orchards) can be made by hand-picking using ladders to access the crown
- taller trees can be climbed with the aid of a climbing pole, but this method should only be used for special collections (such as from seed production areas)

- collections from slash can be done by hand-stripping cones at the cutting site
- alternatively, tops can be transported to a central location where cones can be hand-stripped or mechanically removed using top-strippers and combines

Collection notes
- use cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- since cones are semi-serotinous (i.e. cones may retain their seed for several years following ripening), timing of collections can be flexible
- avoid collecting older cones (i.e. 5 yrs. or older) because of reduced seed yields
- trees on lowland sites will normally retain their seed for longer periods of time, allowing collection to be delayed until late fall or early winter if necessary
- **caution:** if weather conditions are warm and dry in the fall, collections should begin immediately upon seed reaching full maturity to avoid seed loss —especially when collecting from trees on upland sites
- collection from slash must be made soon after the trees are felled since cones close to the ground are frequently subject to temperatures high enough to cause them to open
- cone-bearing branches and tops should not be stored in piles when conditions are warm and damp because heating and moulding will damage seed; cool, dry, well-ventilated storage is necessary when stock-piling fresh material

Storage and shipping procedures
- if possible, ship cones immediately to the processing centre
- for interim storage of early collections, spread cones out under cool, well-ventilated conditions to prevent heating and moulding
- cones collected after October are usually dry enough to be kept in shelters, prior to shipping, without cones overheating, moulding or opening

Red Spruce

Picea rubens Sarg.

Crop intervals
- Three to eight years

Flowering habit
- monoecious, flowering late April to early May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones that are green and close to full size

Forecasting notes
- cones tend to be very resinous
- use cutting test at time of forecasting to check embryo development

Collecting

When to collect
- mid-September to early October

Description of ripe cones and mature seed
- cones are 2 cm to 5 cm long, ovoid to oblong, and composed of many thin closely overlapping scales with rounded slightly wavy margins
- ripe cones are shiny, very resinous, and purplish in colour
- seeds are 3 mm to 4 mm long, rounded at one end and pointed at the other end
- mature seed has a black seed coat, a firm white endosperm and a white-to-yellow embryo that extends nearly the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Picea rubens Sarg.

Forecasting

Collecting

Collection methods
- cones can be collected from standing trees, slash, or squirrel caches
- collections are best made by hand-picking from standing trees using ladders or climbing to access the crown

Collection notes

- use the cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- be sure of species identification; red spruce trees and cones are easily confused with those of white and black spruce

Storage and shipping procedures

- if possible, cones should be shipped immediately to the processing centre
- for interim storage, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and moulding
- daily stirring or raking of cones should be conducted to ensure uniform drying
- cones should not be stored in bags for long periods of time as they will heat and mould

Jack Pine

Pinus banksiana Lamb.

Crop intervals

- one to three years

Flowering habit

- monoecious, flowering in May to June

Forecasting

When to forecast

- last week of June to first week of July

What to look for

- current year's cones that are greenish to greenish brown
- cutting test will reveal embryos

Forecasting notes

- use cutting test at time of forecasting to check embryo development
- note any conelets on current year's growth for indication of next year's crop

Collecting

When to collect

- do not collect the current year's cones until the first week of September
- previous years' cones can be collected at anytime since they remain on the tree indefinitely

Description of ripe cones and mature seed

- cones are 4 cm to 7 cm long, vary in shape from straight to strongly curved, and are composed of smooth, tightly closed scales of varying thickness
- current year's cones are ripe when the colour turns to golden brown
- older cones become grayish in colour
- seeds are 3 mm to 4 mm long, elliptical but tapered slightly to a blunt point at one end
- mature seed has a black seed coat

Pinus banksiana Lamb.

Forecasting

Collecting

Collection methods

- collection normally involves harvesting the current year's crop as well as persistent cones from previous crops
- collections should be limited to cones less than six years old because seed loses viability thereafter
- cones can be collected from standing trees, felled trees in cutover areas, or squirrel caches (in southern Ontario)
- cones near to the ground (as in young stands, felled trees, or slash) are subjected to temperatures capable of opening them; these cones should be collected soon after the seed matures or the trees are felled

- when collecting from standing trees, use ladders or a hydraulic lift to access the upper crown
- since cones are difficult to remove, those collected from standing trees must be carefully clipped off with thin-bladed pruning shears to avoid girdling the branches

Collection notes

- avoid collecting unripened cones, those that are completely gray, or cones that are visibly damaged by insects
- collect cones only when the seed is mature
- jack pine is a serotinous species, therefore seed may be retained in ripe cones for many years
- do not collect cones that are covered with lichen or moss

Storage and shipping procedures

- if possible, ship cones immediately to the processing centre
- cones require minimal care in handling, storage, and shipping
- if interim storage is required, cones can be stored for many months under cool, dry, well-ventilated conditions
- avoid storing cones in direct sunlight

Austrian Pine

Pinus nigra Arnold

Crop intervals
- two to five years

Flowering habit
- monoecious, flowering in May to early June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones that are green and close to full size
- cutting test will reveal embryos

Forecasting notes
- use cutting test at time of forecasting to check embryo development

Rechecking
- monitor seed quality on a regular basis for possible abortion
- note any conelets behind terminal buds for indication of next year's crop

Collecting

When to collect
- mid-September to late November

Description of ripe cones and mature seed
- cones are 5 cm to 9 cm long, ovoid to conical, and are composed of several thick, ridged scales
- ripe cones are greenish yellow
- seeds are 5 mm to 7 mm long, elliptical in shape
- mature seed has a yellowish-brown-to-pale-brown seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Pinus nigra Arnold

Forecasting

Collecting

Collection methods
- cones may be collected from standing trees, felled trees, or squirrel caches
- ladders should be used to access the crowns of standing trees

Collection notes
- avoid collecting unripened cones
- collect cones only when seed is fully mature
- use cutting test to check internal cone and seed features
- timing of collection is somewhat flexible as cone opening and seed dispersal do not begin until December
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed

Storage and shipping procedures
- ship cones immediately to the processing centre when possible
- cool, dry, well-ventilated storage should be used for cones collected early in the fall season
- cones collected in late fall or early winter should be dry enough for cool storage until shipment is possible

Red Pine

Pinus resinosa Ait.

Crop intervals
- three to seven years

Flowering habit
- monoecious, flowering in May to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones should be purplish and half of full size
- embryos should be evident from cutting test

Forecasting notes
- use cutting test at time of forecasting to check embryo development
- note any conelets behind terminal buds for indication of next year's crop

Rechecking
- check constantly as red pine cones will abort rapidly if attacked by insects (such as coneworms); insect-damaged cones will feel rubbery

Collecting

When to collect
- mid-September to late October

Description of ripe cones and mature seed
- cones are 4 cm to 5 cm long, straight, somewhat tapered, and composed of tightly closed scales that are slightly thickened with smooth margins
- ripe cones are reddish brown
- seeds are 4 mm to 6 mm long
- mature seed has a light brown seed coat, a firm white endosperm, and a white-to-yellow embryo that nearly extends the length of the endosperm cavity

Pinus resinosa Ait.

Forecasting

Collecting

- seed is generally mature before the cone exhibits fully ripe characteristics

Collection methods

- cones can be collected from squirrel caches, recently felled or standing trees, or logging slash provided that the seed is mature
- cones are hand-picked from standing trees by climbing or using ladders or hydraulic lifts to access the crown

Collection notes

- avoid collecting unripened cones
- use the cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed

Storage and shipping procedures

- cones should be shipped immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area out of direct sunlight

Eastern White Pine

Pinus strobus L.

Crop intervals
- three to ten years

Flowering habit
- monoecious, flowering in May to early June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones should be green and close to full size
- embryos are quite evident from cutting tests

Forecasting notes
- use cutting test at time of forecasting to check embryo development
- note any conelets behind terminal buds for indication of next year's crop
- resin is naturally abundant on white pine cones and is not an indication of insect or disease damage

Rechecking
- check development of cones and watch for aborted cones

Collecting

When to collect
- mid-August to early October

Description of ripe cones and mature seed
- cones are 12 cm to 18 cm long, cylindrical, slightly tapered, and composed of many large, thin, overlapping, tightly appressed scales
- resin drops are commonly found on the cones
- ripe cones are yellowish brown to light brown
- seeds are 5 mm to 7 mm long, elliptical in shape

Pinus strobus L.

Forecasting

Collecting

- mature seed has a mottled brown seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before the cone exhibits fully ripe characteristics

Collection methods
- collect cones only when seed is mature
- cones can be collected from squirrel caches, standing or felled trees
- collections from standing trees are limited owing to the size of cone-producing trees, their crown shape, and the distribution of cones in the crown

- climbing trees is the principal means of gaining access to the crowns; cones can be hand-picked or clipped using pruning shears
- cones can also be collected from the slash of cutting operations provided the trees are felled when seed is mature

Collection notes
- use cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- avoid collecting unripened cones
- use of gloves is recommended due to the resinous nature of the cones

Storage and shipping procedures
- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area to prevent heating and moulding
- daily stirring or raking of cones should be done to promote even drying and to prevent cones from clumping together
- cones should not be stored in fully packed bags or in unventilated areas as they will heat and mould

Scots Pine

Pinus sylvestris L.

Crop intervals
- one to three years

Flowering habit
- monoecious, flowering in May to early June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones that are green and close to full size
- embryos that are quite evident in cutting test

Forecasting notes
- presence of conelets in fall is a clue to next year's crop
- use cutting test during forecasting to check embryo development

Rechecking
- Watch for cone abortion or insect damage

Collecting

When to collect
- late September to mid-November

Description of ripe cones and mature seed
- cones are 4 cm to 5 cm long, straight, conical, and composed of closely appressed scales that are ridged and somewhat diamond-shaped
- ripe cones are dark green
- seed is 3 mm to 5 mm long, elliptical in shape
- mature seed has a light brown to black and/or mottled seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before cone exhibits fully ripe characteristics

Pinus sylvestris L.

Forecasting

Collecting

Collection methods

- collections are best made by hand-picking from standing trees using ladders or climbing to access the crown

Collection notes

- avoid collecting unripened cones
- use cutting test to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- collect cones only when the seed is mature
- cones can be collected from squirrel caches or standing trees
- timing of collection is quite flexible owing to delayed opening of cone

Storage and shipping procedures

- if possible, ship cones immediately to the processing centre
- if being held prior to shipment, cones should be spread out in a cool, dry, well-ventilated area out of direct sunlight

Northern White Cedar

Thuja occidentalis L.

Crop intervals
- three to five years

Flowering habit
- monoecious, flowering in late April to early May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- cones that are tiny and green and resemble small scales on the end of new growth

Forecasting notes
- seed development cannot be assessed at the time of forecasting

Collecting

When to collect
- late August to mid-October

Description of ripe cones and mature seed
- cones are 8 mm to 12 mm long, oblong, and composed of eight to ten small scales
- ripe cones are pale yellowish green to golden brown
- seed is 3 mm to 4 mm long
- mature seed has a golden brown seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is generally mature before cone exhibits fully ripe characteristics

Thuja occidentalis L.

Forecasting

Collecting

Collection methods
- cones are collected by hand-stripping directly into picking bags or onto ground sheets
- collection is easiest from trees whose crowns are accessible from the ground or with ladders
- seeds can be whipped from the ripe cones of standing trees onto ground sheets using bamboo poles—but not on a windy day!

Collection notes

- avoid collecting unripened cones
- ripe cones disperse seed very quickly so monitor cone development and weather conditions closely
- pull cone apart to check internal cone and seed features
- avoid collecting cones that are visibly damaged by insects, appear malformed, or are void of seed
- collect cones only when seed is mature
- cones can be collected from standing trees or squirrel caches
- cones on trees situated near large bodies of water tend to open later than normal; collections in these areas can be delayed somewhat

Storage and shipping procedures

- if not shipped immediately, cones should be spread out in a cool, dry, well-ventilated area out of direct sunlight to prevent heating and moulding
- partially dry cones can be bagged and shipped to the processing centre

Eastern Hemlock

Tsuga canadensis (L.) Carr.

Crop intervals

- two to three years

Flowering habit

- monoecious, flowering in May to early June

Forecasting

When to forecast

- last week of June to first week of July

What to look for

- cones that are green and about half their full size

Forecasting notes

- check embryo development at the time of forecasting using cutting test

Collecting

When to collect

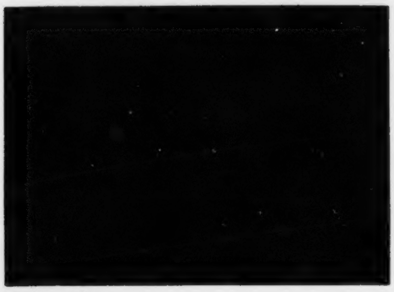
- mid-September to late October

Description of ripe cones and mature seed

- cones are 1 cm to 2 cm long
- ripe cones are greenish brown
- seed is 3 mm to 4 mm long and irregular in shape
- mature seed has a golden brown seed coat, a firm white endosperm and a white-to-yellow embryo that nearly extends the length of the endosperm cavity
- seed is mature before cone exhibits fully ripe characteristics

Tsuga canadensis (L.) Carr.

Forecasting



Collecting

Collection methods

- collect cones from standing trees by hand-picking directly into picking bags or hand-stripping onto ground sheets
- access the crowns using ladders or by climbing
- cones can be whipped from crowns into ground sheets using bamboo poles

Collection notes

- ripe cones disperse seed very quickly so monitor cone development and weather conditions closely
- use cutting test to check internal cone and seed features
- avoid collecting cones that are visibly affected by insects, appear malformed, or are void of seed

Storage and shipping procedures

- if possible, ship cones as soon as possible to the processing centre
- if interim storage is required, cones should be placed in a cool, dry, well-ventilated area to prevent heating or moulding

Hardwoods

Figure 3.
Maple (*Acer* spp.) seed anatomy.

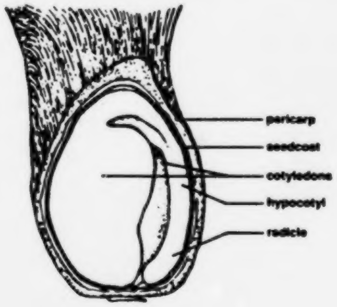

pericarp
seedcoat
cotyledons
hypocotyl
radicle

Figure 4.
Ash (*Fraxinus* spp.) seed anatomy.

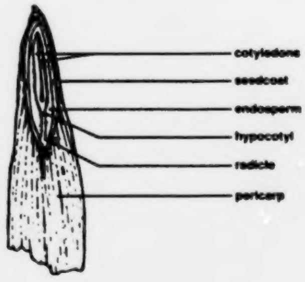

cotyledons
seedcoat
endosperm
hypocotyl
radicle
pericarp

Figure 5.
Oak (*Quercus* spp.) seed anatomy.

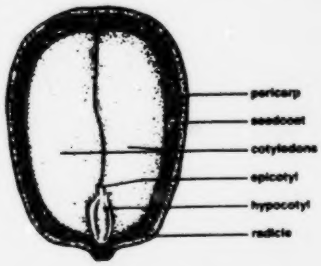

pericarp
seedcoat
cotyledons
epicotyl
hypocotyl
radicle

Figure 6.
Cherry (*Prunus* spp.) seed anatomy.

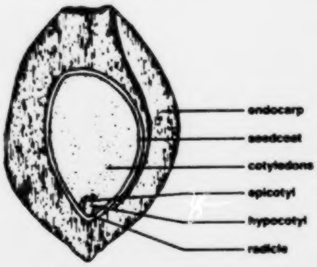
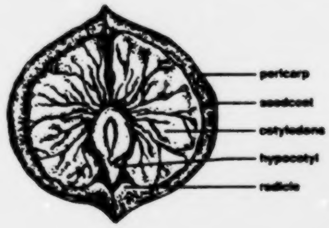

endocarp
seedcoat
cotyledons
epicotyl
hypocotyl
radicle

Figure 7.
Walnut (*Juglans* spp.) seed anatomy.


pericarp
seedcoat
cotyledons
hypocotyl
radicle

Red Maple

Acer rubrum L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering early April to early May

Forecasting

When to forecast
- mid-May

What to look for
- samaras that are reddish green

Forecasting notes
- flowers are very susceptible to spring frosts
- check shortly after flowering for seed development

Collecting

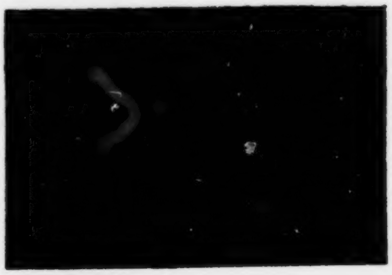
When to collect
- late May to mid-June

Description of ripe fruit and mature seed
- fruits are composed of two winged samaras fused together where their seed cavities meet
- ripe samaras are red
- seed consists of a very well-developed embryo but no endosperm
- mature seed is 3mm to 4mm long, firm, crisp, green, and fully elongated within the seed cavity

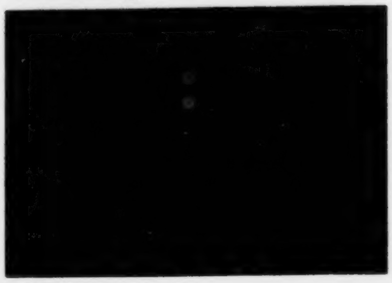
Collection methods
- collections are most often made by spreading tarpaulins beneath the tree and flailing branches with a bamboo pole to dislodge samaras

Collection notes
- collect samaras only when seed is mature

Acer rubrum L.



Forecasting



Collecting

- use cutting test to determine seed development
- seed matures more slowly if trees are near large bodies of water
- collection time is critical because of very quick seed dispersal

Storage and shipping procedures
- samaras should be bagged and **shipped immediately to the nursery** for sowing on the same day of collection
- twigs, leaves, and other debris should be removed before bagging and shipment
- if temporary storage is necessary, samaras should be kept under cool, shaded conditions to avoid heating

Silver Maple

Acer saccharinum L.

Crop intervals
- annual

Flowering habit
- monecious or dioecious, flowering early April to early May

Forecasting

When to forecast
- mid-May

What to look for
- samaras that are green and nearly ripe
- embryos that are still watery

Forecasting notes
- flowers are very susceptible to spring frosts
- check samaras shortly after flowering for seed development
- seed matures more slowly if trees are near large bodies of water

Collecting

When to collect
- late May to mid-June

Description of ripe fruit and mature seed
- fruits are composed of two winged samaras, 4 cm to 6 cm long
- normally only one of the paired samaras will develop a seed while the other side may have aborted; the aborted side is commonly much smaller in size
- ripe samaras are golden brown
- seed consists of a very well-developed embryo but no endosperm
- mature seed is 7 mm to 10 mm long, firm, crisp, green, and fully elongated within the seed cavity

Acer saccharinum L.

Forecasting

Collecting

Collection methods
- collect samaras only when seed is mature
- collections are most often made by spreading tarpaulins beneath the tree and flailing branches with a bamboo pole to dislodge the samaras

Collection notes

- use cutting test to determine seed development
- monitor seed development often because seed matures quickly after flowering is completed

Storage and shipping procedures

- samaras should be bagged and **shipped immediately to the nursery** for sowing on the same day of collection
- twigs, leaves, and other debris should be removed before bagging and shipping
- If temporary storage is necessary, samaras should be kept under cool conditions to avoid heating and drying

Hard (Sugar) Maple

Acer saccharum Marsh.

Crop intervals

- three to seven years

Flowering habit

- monoecious, flowering mid-April to May

Forecasting

When to forecast

- last week of June to first week of July

What to look for

- samaras are green and mature in size and shape

Forecasting notes

- do not look for seeds at this time because embryos appear as tiny specks, if at all

Rechecking

- Check seeds during the latter part of July for embryo development
- generally, half the seeds are fully developed at rechecking or collecting time

Collecting

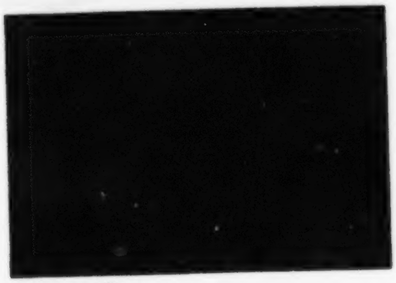
When to collect

- late September to mid-October

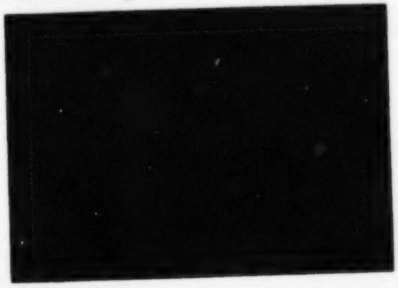
Description of ripe fruit and mature seed

- fruits are composed of two winged samaras fused together where their seed cavities meet
- ripe samaras are yellowish brown
- the seed consists of a very well-developed, bright green embryo but no endosperm
- mature seed is firm, crisp, green, and fully elongated within the seed cavity
- collect samaras only when seed is mature

Acer saccharum Marsh.



Forecasting



Collecting

Collection methods

- collections soon after seed is mature can be made by hand-picking from standing trees
- collections after the leaves have fallen are easier and can be made by spreading tarpaulins beneath the tree and flailing the branches with a bamboo pole to dislodge samaras

Collection notes

- use cutting test to determine seed development
- normally only one of the paired samaras will develop a seed and the other will abort; unlike silver maple, both samaras attain equal size making it impossible to check externally which side is filled
- timing of collection is not critical because samaras persist on the tree for several weeks after reaching full ripeness

Storage and shipping procedures

- samaras should be bagged and **shipped immediately to the nursery**
- leaves, twigs, and other debris should be removed before bagging and shipping
- if temporary storage is necessary, samaras should be kept under cool conditions to prevent heating

Juneberry

Amelanchier canadensis (L.) Medic.

Crop intervals
- two to three years

Flowering habit
- monoecious, flowering in April

Forecasting

When to forecast
- end of June to first week in July

What to look for
- small green fruit

Forecasting notes
- trees are easier to find while in flower
- trees in open areas usually have a heavy flower crop but produce very little mature fruit

Collecting

When to collect
- mid-July

Description of ripe fruit and mature seed
- ripe fruits are small reddish purple berries, 12 mm to 15 mm in diameter, resembling miniature apples
- berries consist of a mass of juicy pulp in which several seeds are embedded
- seeds are 3 mm to 4 mm long, and crescent-shaped
- mature seed is hard and brown
- seed has a large, white, well-developed embryo but no endosperm
- collect berries only when the seed is mature

Amelanchier canadensis
(L.) Medic.

Forecasting

Collecting

Collection methods
- berries are most easily collected by hand-picking

Collection notes
- collections are often missed due to the very early ripening date of the berries
- berries ripen in stages so plan collections accordingly
- fruit should be collected as soon as it is ripe to reduce losses to birds and animals

Storage and shipping procedures
- berries should be shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time as the juices may ferment and heat, causing damage to the seed
- if being held prior to shipment, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

Yellow Birch

Betula alleghaniensis Britt.

Crop intervals
- two years

Flowering habit
- monoecious, flowering late April to May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- green catkins

Forecasting notes
- be careful to properly distinguish male from female catkins—male catkins generally occur in clusters

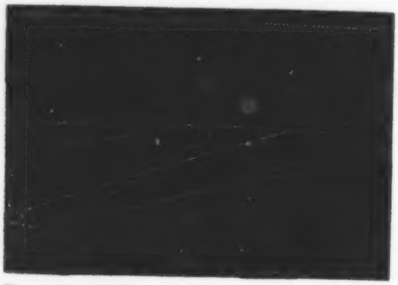
Collecting

When to collect
- mid-September to mid-October

Description of ripe fruit and mature seed
- fruits are small catkins, 3 cm to 4 cm long
- catkins are composed of many small, closely overlapping scales
- ripe catkins are brown
- seeds are 3 mm to 4 mm long, oval- to heart-shaped
- mature seed is golden brown

Collection methods
- catkins are best collected by hand-picking or hand-stripping directly into bags
- ladders should be used to access the crown
- pole pruners or pruning shears are useful for removing branches to permit safer and easier ground collection
- catkins can also be collected from trees felled during cutting operations but timing must be perfect

Betula alleghaniensis Britt.



Forecasting

Collecting

Collection notes

- be sure to collect only the female catkins
- ripe catkins shatter easily, so bag directly when collecting
- collection should be timed so that seed is mature but catkins are still green enough to hold together

Storage and shipping procedures

- if possible, ship catkins immediately to the processing centre
- if being held prior to shipment, catkins should be spread out in a cool, dry, well-ventilated area to prevent heating and moulding
- do not store freshly collected material in bags as heating can occur, causing loss of seed viability

Caragana

Caragana arborescens Lam.

Crop intervals
- annual

Flowering habit
- monoecious, flowering late May to early June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- pods that are green

Collecting

When to collect
- late July to mid-August

Description of ripe fruit and mature seed
- fruits are small pods, 2 cm to 5 cm long
- ripe pods are amber brown
- pods contain four to six small oblong seeds
- mature seeds are shiny, deep reddish brown, and may be mottled in appearance, consisting of a hard seed coat surrounding a large, white, well-developed embryo but no endosperm

Collection methods
- pods should be collected by hand-picking directly into picking bags before they begin to open

Collection notes
- timing of collections is important since the pods open when fully ripened to release their seed

Caragana arborescens Lam.

Forecasting

Collecting

Storage and shipping procedures
- if possible, ship pods immediately to the processing centre
- if being held prior to shipment, pods should be spread out in a cool, dry, well-ventilated area to prevent heating
- after spreading out, cover pods with screening to prevent seed dispersal as pods dry and open
- when pods are dry, they can be bagged and shipped to the processing centre

Red-Osier Dogwood

Cornus stolonifera Michx.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to July

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- fruit occurs in clusters and varies from green to white

Forecasting notes
- be sure of species identification

Collecting

When to collect
- mid-July to mid-September

Description of ripe fruit and mature seed
- fruits are small berries, 6 mm to 8 mm in diameter
- ripe berries are snowy white
- each berry contains a single bony stone
- a stone consists of a hard outer shell surrounding two seeds in separate cavities; normally, only one seed develops fully
- mature stones are gray
- a mature stone has a very small, white embryo surrounded by a large amount of endosperm

Collection methods
- hand-picking or hand-stripping berries directly into picking bags or onto ground sheets is the best method of collection

Cornus stolonifera Michx.

Forecasting

Collecting

Collection notes
- be sure of species identification
- berries should be collected when their colour changes from green to white
- berries should be collected as soon as they are ripe to reduce loss to birds

Storage and shipping procedures
- if possible, berries should be bagged and shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- if being held prior to shipment, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

Russian Olive

Elaeagnus angustifolia L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering in June

Forecasting

When to forecast
- late July

What to look for
- fruit that is whitish green

Forecasting notes
- be sure of species identification

Collecting

When to collect
- early September to mid-November

Description of ripe fruit and mature seed
- fruits are 8 mm to 12 mm long, oval to elliptical in shape, and consist of a thick dry husk surrounding a single large seed
- ripe fruits are whitish to silvery green in colour
- seeds are 6 mm to 10 mm in length, oval in shape
- mature seed has a light brown seed coat with dark brown stripes (resembling miniature watermelons)

Collection methods
- fruits are best collected from standing trees or shrubs by hand-picking or hand-stripping fruits directly into picking bags or onto ground sheets
- fruits can also be whipped from the crowns onto ground sheets using bamboo poles

Elaeagnus angustifolia L.

Forecasting

Collecting

Collection notes
- timing of collection is flexible since the fruits persist on the tree for several months after the seed is mature
- be careful not to damage this ornamental tree during collection

Storage and shipping procedures
- fruits should be bagged and shipped to the processing centre immediately after collection
- for shipping, fruit should be placed in plastic bags inside burlap bags

White Ash

Fraxinus americana L.

Crop intervals
- three to five years

Flowering habit
- dioecious, flowering mid-April to May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- samaras hang in clusters
- several purple-green samaras per stem
- seed is close to full size at this time

Forecasting notes
- be careful to base seed forecast only on female trees
- seed is almost mature by this time

Rechecking
- check frequently throughout the season because the seed can abort quickly

Collecting

When to collect
- mid-October to mid-November after leaf fall

Description of ripe fruit and mature seed
- fruits are winged, single-seed samaras, 3 cm to 5 cm long
- ripe samara is brown and grows in clusters
- mature seed is firm, crisp, white, and fully elongated within the seed cavity

Collection methods
- collections are best made after leaf fall by flailing branches with a bamboo pole to dislodge samaras onto ground tarps
- use ladder to access the crown for collecting by hand or with seed hooks or pruners

Fraxinus americana L.

Forecasting

Collecting

Collection notes
- species identification may be difficult: white ash leaves turn purple in autumn, bark is chocolate brown with white spots on new growth
- use cutting test to determine seed development within samara
- timing of collection is flexible since samaras persist on the tree for several weeks after the seed is fully mature

Storage and shipping procedures
- samaras should be bagged and shipped to the nursery immediately after collection
- remove twigs, leaves and other debris before bagging for shipment
- if temporary storage is necessary samaras should be kept under cool, dry conditions

Black Walnut

Juglans nigra L.

Crop intervals
- monoecious, two to three years

Flowering habit
- mid-May to early June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- small, greenish fruit, half the mature size (versus greenish bronze fruit on butternut)

Forecasting notes
- be sure of species identification as it can be confused with butternut

Collecting

When to collect
- September to October depending on fall frosts

Description of ripe fruit and mature seed
- fruits are round, 4 cm to 5 cm in diameter, and consist of a thick, pulpy husk surrounding a single, large nut (versus oblong fruits, occurring singly or grouped, on butternut)
- the fruits are yellowish green when ripe but turn brown to black after fall frosts
- mature nuts are dark brown with hard woody shells enclosing a large endosperm and a small, well-developed embryo
- the nuts are rough and marked with long, rounded ridges (versus deeply pitted nuts with long, jagged ridges for butternut)

Juglans nigra L.

Forecasting

Collecting

Collection methods

- fruits fall from trees after heavy fall frosts, so wait until then to collect
- fruits can be removed from the tree by flailing branches with a bamboo pole
- fruits can also be gathered from squirrel caches

Collection notes

- use cracking test to check for embryo development
- husks have a pungent odour and contain very strong dyes that can cause permanent stains
- the wearing of gloves and old clothing is strongly recommended when handling these fruits
- begin collections promptly to reduce losses to squirrels

Storage and shipping procedures

- nuts should be shipped immediately to the nursery

Tulip-Tree

Liriodendron tulipifera L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to June

Forecasting

When to forecast
- last week of July

What to look for
- elongated green fruit

Collecting

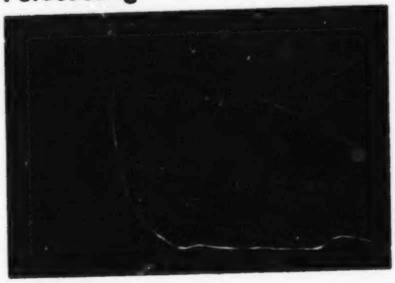
When to collect
- August to October

Description of ripe fruit and mature seed
- fruit is a single-winged samara, 3 cm to 4 cm in length
- samaras occur in aggregate, cone-like structures containing as many as 80 individual samaras
- each samara contains two seeds but one of these usually aborts
- ripe samaras are light brown
- mature seed is firm, crisp, white, and fully elongated within the seed cavity

Collection methods
- collect mature cone-like structures from squirrel caches, newly felled or standing trees
- collections beginning in mid-September are best made by hand-picking directly into picking bags from standing trees using a hydraulic lift or by climbing to access the crown
- fruits can be whipped from the crowns onto ground sheets using bamboo poles

Liriodendron tulipifera L.

Forecasting



Collecting

Collection notes
- fruit from the upper two-thirds of the crown yields more filled seed than fruit from the lower third
- timing of collections is not critical because seed dispersal is gradual

Storage and shipping procedures
- collections should be shipped immediately to the processing centre
- if being held, early collections should be spread out in a cool, dry, well-ventilated area
- later collections are normally dry enough to be bagged and stored until shipping

Tatarian Honeysuckle

Lonicera tatarica L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to mid-July

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- fruit that is small and green
- usually two berries are attached on the same stem

Collecting

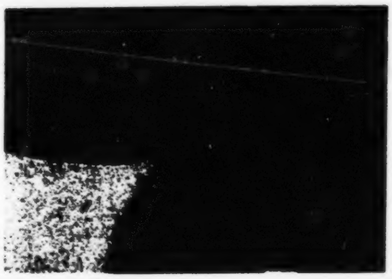
When to collect
- mid-July to mid-August

Description of ripe fruit and mature seed
- fruits are small berries, 8 mm to 10 mm in diameter
- ripe berries are orange or red
- each berry consists of a fleshy outer pulp in which two to seven seeds 4 mm long are embedded
- mature seed has a golden brown seed coat

Collection methods
- ripe berries should be hand-picked into picking bags or stripped onto ground sheets

Collection notes
- **be sure of species identification**
- berries ripen in stages so plan collections accordingly
- collect as soon after ripening as possible to reduce losses to birds
- collect from bushes isolated from other honeysuckles as this species commonly hybridizes

Lonicera tatarica L.



Forecasting

Collecting

Storage and shipping procedures
- berries should be bagged and shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time because the juices may ferment, then heat and damage the seed
- if being held prior to shipment, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

White Oak

Quercus alba L.

Crop intervals
- four to ten years

Flowering habit
- monoecious, flowering in May

Forecasting

When to forecast
- last week of July

What to look for
- acorns that are very small and green

Forecasting notes
- acorns develop in one year

Rechecking
- acorns are yellow when nearly ripe

Collecting

When to collect
- early October

Description of ripe fruit and mature seed
- fully ripened nuts are called acorns
- acorns are 12 mm to 18 mm long, oval, and covered at one end by a small, scaly, chestnut-brown cap
- ripe acorns are brown
- each acorn contains a large, well-developed embryo but no endosperm although two large, fleshy cotyledons are often mistaken as such

Collection methods
- collect ripe acorns by flailing branches with a bamboo pole or by gathering from the ground after frosts

Collection notes
- be sure of species identification
- use cutting test to determine internal seed features and possible insect damage

Quercus alba L.

Forecasting

Collecting

- begin collecting acorns when ripe because they will germinate while still on the tree or soon after falling to the ground
- acorns should be tested prior to collection or purchase; sound acorns will sink when placed in water while hollow, insect-damaged or low moisture content acorns will float

Storage and shipping procedures
- because acorns germinate in the fall, they cannot be stored
- ship immediately to the nursery by the fastest available means

Red Oak

Quercus rubra L.

Crop intervals
- three to five years

Flowering habit
- monoecious, flowering in May

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- acorns that are green and beginning to emerge from cap in second year

Forecasting notes
- acorns take two years to mature

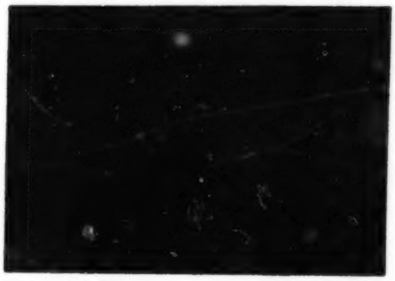
Collecting

When to collect
- late September to mid-October depending on fall frosts

Description of ripe fruit and mature seed
- fully ripened nuts are called acorns
- acorns are 12 mm to 18 mm long, oval, and covered at one end by a small, scaly, brown cap
- ripe acorns are reddish brown
- each acorn contains a large, well-developed embryo but no endosperm although two large, fleshy cotyledons are often mistaken as such

Collection methods
- collect ripe acorns from the ground after frosts or by flailing acorns from the crowns onto ground sheets using bamboo poles

Quercus rubra L.



Forecasting

Collecting

Collection notes

- be sure of species identification
- use cutting test to determine internal seed features, checking carefully for insect damage
- timing of collections is very important to reduce losses to squirrels
- acorns should be tested prior to collection or purchase; sound acorns will sink when placed in water while hollow, insect-damaged or low moisture content acorns will float

Storage and shipping procedures

- ship immediately to the nursery by the fastest available means

Black Locust

Robinia pseudoacacia L.

Crop intervals

- two years

Flowering habit

- monoecious, flowering in May

Forecasting

When to forecast

- late August

What to look for

- seed pods that are greenish brown

Forecasting notes

- heavy flowering is not always indicative of a heavy seed crop since pollination is sometimes poor
- forecast when pods are evident

Collecting

When to collect

- late October until spring

Description of ripe fruit and mature seed

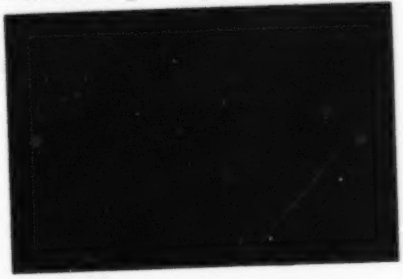
- fruits are large pods 5 cm to 7 cm long and similar in appearance to garden peas
- ripe pods are brown
- each pod contains several small, hard seeds 3 mm to 5 mm long
- mature seed has a black seed coat (but sometimes speckled or mottled in appearance) and a single, large, well-developed embryo but no endosperm

Collection methods

- collections are best made by flailing pods from the branches onto ground sheets with a bamboo pole

Robinia pseudoacacia L.

Forecasting



Collecting

Collection notes
- open pods to determine seed development
- timing of collections is not critical because the pods remain closed and may stay on the tree for several months after seeds are fully mature
- collections should be made before pods open to obtain maximum seed yield

Storage and shipping procedures
- if possible, ship pods immediately to the processing centre
- if being held prior to shipment, pods should be spread out in a cool, dry, well-ventilated area to prevent moulding

Multiflora Rose

Rosa multiflora Thunb.

Crop intervals
- one to two years

Flowering habit
- monoecious, flowering May to mid-July

Forecasting

When to forecast
- last week of July

What to look for
- clusters of green fruit

Forecasting notes
- never forecast based on flowering—wait until fruits are evident

Collecting

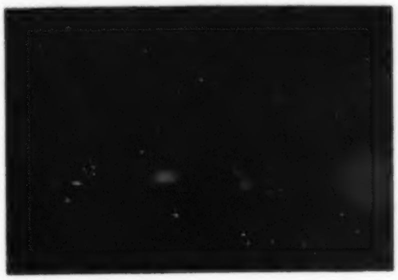
When to collect
- mid-November onwards, depending on fall frosts

Description of ripe fruit and mature seed
- fruits are fleshy, berry-like rose hips in which are found one to seven seeds
- ripe rose hips are orange-red in colour and occur in clusters
- mature seed has a golden brown seed coat

Collection methods
- collect ripe rose hips by hand-picking directly into picking bags after a heavy frost; frost will soften fruit and aid in the de-pulping process

Collection notes
- use cutting test to determine internal fruit and seed features
- gloves should be worn during collection

Rosa multiflora Thunb.



Forecasting

Collecting

Storage and shipping procedures
- if possible, hips should be shipped immediately to the processing centre
- for shipping, hips should be placed in plastic bags inside burlap bags
- hips should not be left in bags for long periods of time because the juices may ferment and heat, causing damage to the seed
- if being held prior to shipment, **hips should be placed in tubs of cold water**
- do not allow hips to dry out

European Mountain Ash

Sorbus aucuparia L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- small green clusters of berries

Forecasting notes
- double check identification of species because other mountain ashes are similar

Collecting

When to collect
- early September to late October

Description of ripe fruit and mature seed
- fruits are small, round berries, 6 mm to 12 mm in diameter
- ripe berries are bright orange to bright red in colour and grow in clusters
- each berry consists of a fleshy outer pulp in which are embedded two to five cells containing one or two seeds
- mature seed is small, 2mm to 4mm in length, and golden brown to brown in colour
- each seed contains a well-developed, white embryo but no endosperm

Sorbus aucuparia L.

Forecasting

Collecting

Collection methods

- collect berries by stripping onto ground sheets or by hand-picking directly into picking bags

Collection notes

- collect berries as soon as seed is mature to reduce losses to birds

Storage and shipping procedures

- if possible, berries should be shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time because the juices may ferment and heat, causing damage to the seed
- if immediate shipment is not possible, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

Showy Mountain Ash

Sorbus decora (Sarg.) Schneid.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- small, green clusters of berries

Forecasting notes
- double check identification of species because other mountain ashes are similar

Collecting

When to collect
- mid-August to late September

Description of ripe fruit and mature seed
- fruits are small, round berries, 6 mm to 12 mm in diameter
- ripe berries are vermillion red in colour
- each berry consists of a fleshy outer pulp in which are embedded two to five cells containing one or two seeds
- mature seeds are small, 2 mm to 4 mm in length, and golden brown to brown in colour
- each seed contains a well-developed, white embryo but no endosperm

Collection methods
- collect berries by stripping onto ground sheets or by hand-picking directly into picking bags

Collection notes
- collect berries as soon as seed is mature to reduce losses to birds

Sorbus decora (Sarg.) Schneid.

Forecasting

Collecting

Storage and shipping procedures
- if possible, berries should be shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time because the juices may ferment and heat, causing damage to the seed
- if immediate shipment is not possible, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

Nannyberry

Viburnum lentago L.

Crop intervals
- annual

Flowering habit
- monoecious, flowering May to June

Forecasting

When to forecast
- last week of June to first week of July

What to look for
- fruit clusters that are green and newly formed

Forecasting notes
- nannyberry occurs naturally in low, wet areas

Collecting

When to collect
- mid-September to mid-October

Description of ripe fruit and mature seed
- fruits are berries that consist of a moist outer pulp surrounding a single seed
- ripe berries are blue-black in colour
- seeds are thin, flat, rounded, and 8 mm to 12 mm in diameter
- mature seed has a yellow seed coat with brown spots

Collection methods
- collect ripe berries by stripping onto ground sheets or by hand-picking directly into picking bags

Collection notes
- be sure of species identification
- wait until berries soften before collecting
- once softened, collect promptly to avoid excessive losses to birds

Viburnum lentago L.

Forecasting

Collecting

Storage and shipping procedures

- if possible, berries should be shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time because the juices may ferment and heat, causing damage to the seed
- if immediate shipment is not possible, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

American High-bush Cranberry

Viburnum trilobum L.

Crop intervals

- annual

Flowering habit

- monoecious, flowering May to June

Forecasting

When to forecast

- last week of June to first week of July

What to look for

- fruit clusters that are green and newly formed

Forecasting notes

- this species is easily confused with European high-bush cranberry (*Viburnum opulus*)
- American high-bush cranberry is found naturally in low, wet areas and along riverbanks

Rechecking

- check in late July because seed can abort quickly

Collecting

When to collect

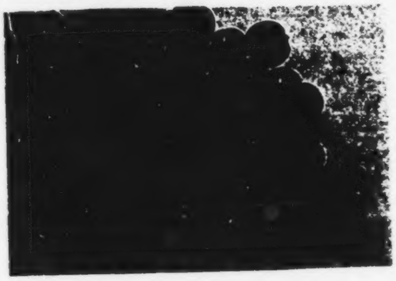
- mid-September to late October

Description of ripe fruit and mature seed

- fruits are berries that consist of a fleshy outer pulp surrounding a single seed
- ripe berries are bright red, juicy, and occur in clusters
- seeds are thin, flat, rounded, and 8 mm to 12 mm in diameter
- mature seed has a pink seed coat

Viburnum trilobum L.

Forecasting



Collecting

Collection methods

- collect ripe berries by stripping onto ground sheets or by hand-picking directly into picking bags

Collection notes

- wait until berries soften before collecting
- once softened, collect promptly to avoid excessive losses to birds

Storage and shipping procedures

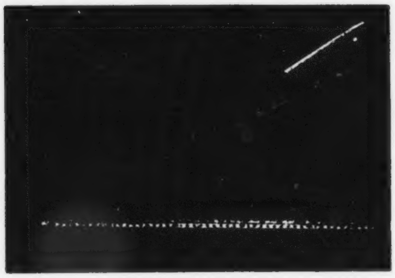
- if possible, berries should be shipped immediately to the processing centre
- for shipping, berries should be placed in plastic bags inside burlap bags
- berries should not be left in bags for long periods of time because the juices may ferment and heat, causing damage to the seed
- if immediate shipment is not possible, **berries should be placed in tubs of cold water**
- do not allow berries to dry out

Appendix I: The Cutting Test

Since insect damage may not be immediately evident, using the cutting test procedure ensures the quality of seed to be collected or purchased.

The cutting test is done by using a cutting knife (as shown below) to cut the cone in half, lengthwise along its axis. Halving the cone or seed allows you to examine seed maturity, presence of internal insect damage and estimate seed yield per cone in the case of conifers. This test should be done before any collections or purchases are made to ensure that cones or other such seed encasements (e.g. nuts or acorns) are not empty and contain viable seed.

Potential yield per cone can be determined by counting the number of seeds visible in one half and multiplying by a factor of four.



Appendix II: Seed Yield By Species

Table 1: Seed Yield for Some Conifer Species

Species	Average viable Seed per Gram*	Average viable Seed per Hectolitre
European larch	151	23249
Tamarack	301	239161
Japanese larch	120	39491
Eastern white pine	40	36247
Red pine	122	82238
Jack pine	270	162226
Scots pine	139	105958
Austrian pine	30	20512
Norway spruce	101	112820
Black spruce	873	352555
Red spruce	310	182955
White spruce	370	317111
Hemlock	98	187358
Northern white cedar	384	450060

* Provincial averages calculated using cumulative inventory data from 1955 to 1985 inclusive.

Source: Ontario Seed Tree Plant,
Ministry of Natural Resources,
Angus, Ontario.
1985.

Table 2: Seed Yields for Some Hardwood Species

Species	Average viable Seed per Gram (or Litre)*	Average viable Seed per Hectolitre
Hard (sugar) maple	566 (L)	56600
Juneberry	17	10997
Yellow birch	176	209100
Caragana	35	95494
Russian olive	3	40842
Autumn olive	15	68193
White ash	1316 (L)	131600
Tulip tree	1	10997
Tatarian honeysuckle	11	23444
Black locust	43	46956
Multiflora rose	81	300090
European mountain ash	16	4138
Showy mountain ash	25	13094
American high-bush cranberry	15	68193

* Provincial averages calculated from cumulative inventory data from 1955 to 1985 inclusive.

Source: Ontario Tree Seed Plant,
Ministry of Natural Resources,
Angus, Ontario.
1985

Appendix III: Seed Source Identification

Ministry of Natural Resources Policy (FR 11 01 01: Tree Seed Identification) and Procedure (FR 11 01 10: Tree Seed Identification) requires that all seed collections be identified by a unique number.

The Seed Source Number (SSN) is comprised of five numeric codes representing the species, site region, geographic location, agency, and collection type. Tables 3–7 list the codes for the five components of the SSN. Figure 8 shows the site regions in Ontario.

The codes in Tables 3–7 are combined to produce a seed source number in the following way:

000-00-00-0-00

species ....
site region ....
geographic location ....
agency ....
collection type ....

The following is an example of a SSN for a collection undertaken in 1979:

012-52-51-0-47 1979

The Seed Source Number identifies a Ministry collection from the seventh white spruce Seed Production Area located in the Algonquin Park District, Site Region 5E.

For more information on any of the following codes, consult Procedure FR 11 01 10.

Table 3: Species Codes

001	eastern white pine	*Pinus strobus*
002	red pine	*Pinus resinosa*
003	jack pine	*Pinus banksiana*
004	Scots pine	*Pinus sylvestris*
006	Austrian pine	*Pinus nigra*
012	white spruce	*Picea glauca*
013	black spruce	*Picea mariana*
014	red spruce	*Picea rubens*
015	Norway spruce	*Picea abies*
019	eastern hemlock	*Tsuga canadensis*
022	northern white cedar	*Thuja occidentalis*
025	tamarack	*Larix laricina*
026	European larch	*Larix decidua*
027	Japanese larch	*Larix leptolepis*
030	hard (sugar) maple	*Acer saccharum*
032	red maple	*Acer rubrum*
033	silver maple	*Acer saccharinum*
037	yellow birch	*Betula alleghaniensis*
040	white oak	*Quercus alba*
041	red oak	*Quercus rubra*
046	white ash	*Fraxinus americana*
054	black walnut	*Juglans nigra*
060	tulip tree	*Liriodendron tulipifera*
061	black locust	*Robinia pseudoacacia*
118	juneberry	*Amelanchier canadensis*
122	caragana	*Caragana arborescens*
127	red-osier dogwood	*Cornus stolonifera*
129	Russian olive	*Elaeagnus angustifolia*
135	tatarian honeysuckle	*Lonicera tatarica*
143	multiflora rose	*Rosa multiflora*
146	European mountain ash	*Sorbus aucuparia*
147	showy mountain ash	*Sorbus decora*
152	nannyberry	*Viburnum lentago*
153	American high-bush cranberry	*Viburnum trilobum*

Table 4: Site Region Codes

Site Region			
12	1E	43	4S
22	2E	44	4W
24	2W	52	5E
32	3E	53	5S
33	3S	62	6E
34	3W	72	7E
42	4E		

Figure 8: Map of Site Regions of Ontario.

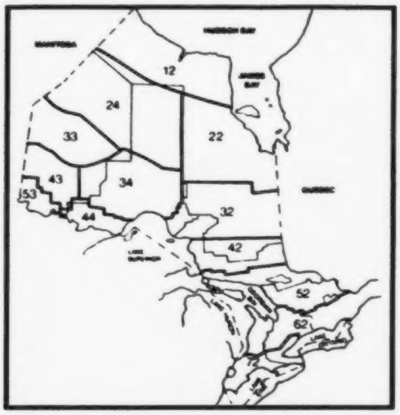


Table 5: Geographic Location Codes

Location	
10	Northwestern Region
11	Dryden
12	Fort Frances
13	Ignace
14	Kenora
15	Red Lake
16	Sioux Lookout
17	Wabigoon Nursery
20	North Central Region
21	Atikokan
22	Geraldton
23	Nipigon
24	Terrace Bay
25	Thunder Bay
27	Thunder Bay Nursery
30	Northern Region
31	Chapleau
32	Cochrane
33	Gogama
34	Hearst
35	Kapuskasing
36	Kirkland Lake
37	Moosonee
38	Timmins
39	Swastika Nursery
40	Northeastern Region
41	Blind River
42	Espanola
43	North Bay
44	Sault Ste. Marie
45	Sudbury
46	Temagami
47	Wawa

50	Algonquin Region
51	Algonquin Park
52	Bancroft
53	Bracebridge
54	Minden
55	Parry Sound
56	Pembroke
60	Eastern Region
61	Brockville
62	Cornwall
63	Carleton Place
64	Napanee
66	Tweed
67	Kemptville Nursery
70	Central Region
71	Huronia
72	Cambridge
73	Lindsay
74	Maple
75	Niagara
76	Orono Nursery
77	Midhurst Nursery
78	Ontario Tree Seed Plant
80	Southwestern Region
81	Aylmer
82	Chatham
83	Owen Sound
84	Simcoe
85	Wingham
86	St. Williams Nursery

Table 6: Agency Codes

0	Ministry of Natural Resources
1–9	Others

Table 7: Collection Type Codes

00	General Collection
01–19	Gene Pool Reserve
21–39	Seed Collection Area
41–59	Seed Production Area
61–79	Seed Orchard
81–99	Special Collection

Appendix IV:

Addresses of MNR Seed Processing Facilities

Ontario Tree Seed Plant
P.O. Box 70
Angus, Ontario
L0M 1B0

Superintendent: (705) 424-5311

Wabigoon Nursery
P.O. Box 90
Wabigoon, Ontario
P0V 2W0

Superintendent: (807) 938-6326

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